(1) Prestress layer - concave/convex attachment

The Applicants respectfully disagree with the Examiner's statement that the prestress layer could be attached to either the concave or convex side of the piezoelectric element. Corwin and Haertling teach a tensile stressed coating (Corwin)/reduced portion (Haertling) and a compressively stressed electrically active shell (Corwin)/electrically active portion (Haertling). When a prestress (tensile) layer is applied to the outside (convex) surface of a hollow sphere of piezoelectric material, as taught by Corwin, the combined two layers will attempt to become more concave toward the outside of the sphere; i.e., toward the prestressing layer side. The spherical shape, however, prevents the flattening of its surface at any point since that would require other points of the sphere's surface to become more convex. In Haertling's wafer, the tension/compression state results (unlike the sphere) in the two portions becoming more concave toward the reduced portion side, due to the nature of the stresses induced and the materials' reaction thereto. Therefore, the electrically active portion will always be more concave toward the reduced side. As a result, the prestressing layer could not be applied to either the concave or convex side.

Furthermore, the stress plating taught by Corwin has a fundamentally different purpose from that of Haertling. Corwin's stress plating on the outside of the sphere seeks to contain piezoelectrically-generated stresses, and Corwin inherently allows only very small mechanical output motion. The spherical shape of the transducer prevents, rather than promotes, the large mechanical output motion desired by Haertling.

(2) Integral/Separable Elements

Applicants again assert that the "separation" of a chemically reduced portion of a monolithic structure from the unreduced portion of that monolithic structure, and the substitution with bonded layers, is neither obvious nor is it analogous to the substitution of a removable cap of a lipstick holder for a press fitted cap, *In re Dulberg*, 289 F.2d 522, 523, 129 USPQ 348, 349 (CCPA 1961), or the substitution of an integral brake drum apparatus for a single unit with rigidly secured parts, *In re*

Larson, 340 F.2d 965, 968, 144 USPQ 347, 349 (CCPA 1965), (referencing MPEP 2144.04(V)(B) and (C)).

Applicants further refer the Examiner to *Schenck v. Nortron Corp.*, 713 F.2d 782, 218 USPQ 698 (Fed. Cir. 1983) (referencing MPEP 2144.04 (V)(B)). In Schenck, the court found the argument that the invention, a vibratory testing machine, was just making integral what had been made in four bolted pieces unpersuasive, holding that the claims were "patentable because the prior art perceived a need for mechanisms to dampen resonance, whereas the inventor eliminated the need for dampening via the one-piece gapless support structure, showing insight that was contrary to the understanding and expectations of the art." (MPEP 2144.04 (V)(B), emphasis added) The present invention uses separate prestress and piezoelectric layers, which is explicitly taught against in Haertling. Haertling teaches a prestressed ceramic device and method, and explicitly discounts bonding of separate layers; instead, Haertling perceives a need for eliminating bonded components. Corwin uses separate layers, but is directed to a different problem than Haertling and produces a fundamentally different response. Use of separate layers to achieve internal asymmetric stress with accompanying large mechanical output is contrary to the teachings and expectations of Haertling and Corwin. Furthermore, Haertling produces the desired compression in only part of the thickness of the ceramic. The reduced portion of the ceramic is in undesirable tension, which inhibits the reliability desired. Furthermore, the properties obtainable from the reduced layer depend upon the electroactive ceramic material. The present invention places the entire piezoelectric layer in compression, and the piezoelectric and prestress layers are distinct from one another. Lastly, claim 17 has been amended to clarify the present invention.

The Examiner further argues that it would have been obvious to one of ordinary skill in the art that Haertling could be provided as two separate, bonded, layers, as Corwin explicitly teaches providing a prestress layer as a separate element and Haertling teaches that a separate layer device was known before the monolithic structure was preferred. The Applicants reiterate their earlier arguments that Haertling states that none of the prior art approaches, including bonding various materials to a

piezoelectric element (see col. 2, lines 30-67), could produce a piezoelectric device having the desired functionality, i.e., including the ability to produce relatively large strains and sustain moderate loads, as well as have an asymmetrical internal stress bias to produce above-plane axial displacement (see also col. 4, lines 19-26). Furthermore, Haertling introduces prestress into the ceramic device. Thus, Haertling explicitly teaches away from a bonded, layered structure to produce the desired internal asymmetrical stress utilizing a prestressed ceramic element. In addition, as stated above, Corwin teaches a device that has a fundamentally different purpose and results than Haertling. Therefore, there is no explicit or implied motivation to modify the monolithic device of Haertling to achieve the desired stress state with the plural, bonded layers of Corwin, nor is there a reasonable expectation of success from such modification, in view of the prior art reviewed by Haertling. Thus, the present invention shows insight that is contrary to the understanding and expectations of the art cited by the Examiner, as well as the art cited by Haertling. Haertling teaches away from using separate, bonded layers. Haertling does not merely state that bonded layers would provide inferior properties; instead Haertling states that bonded layers would be unlikely to produce the result sought, which is the ability to produce relatively large strains and sustain moderate loads, as well as have an asymmetrical internal stress bias to produce above-plane axial displacement (see col. 4, lines 19-26).

Therefore, the combination of Haertling and Corwin do not teach the claimed invention as a whole, including the convex surface of the prestressing layer bonded to the concave surface of the piezoelectric layer and imparting a prestress on the piezoelectric layer such that the piezoelectric layer is in compression. Therefore, Applicants respectfully submit that claims 17 and claims 18-24 that depend therefrom are not obvious over Haertling in view of Corwin.

In view of the above, Applicants submit that the present invention as claimed is not obvious. Thus, reconsideration of the amended application and early allowance is respectfully requested.

The Examiner is invited to contact the undersigned at (757) 864-3230 to discuss any matter concerning this application.

Respectfully submitted,

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